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Vol.	Vol.
1. 3 numbers, 1928.	(None of No. 2).
2. 4 " 1929.	10. 4 " 1939
4. 4 " 1931.	(None of No. 4).
5. 2 " 1932.	12. 4 " 1941
6. 2 " 1933.	(None of Nos. 1 and 2).
7. 1 number, 1934.	13. 4 numbers, 1942.
8. 4 numbers, 1935-37	14. 4 " 1943.
(None of Nos. 2 and 4).	15. 4 " 1944.
9. 4 numbers, 1938	16. 4 " 1945.

ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular*:—

Vol. 1, 1920, 12 numbers.	Vol. 4, 1923, 1 number.
" 2, 1921, 5 "	" 5, 1924-5, 2 numbers.
" 3, 1922, 4 "	

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

ANNUAL BULLETINS.

THE Annual Bulletin of Divisional Reports ran from 1931 to 1938 and was then discontinued.

OLD ISSUES OF AGRICULTURAL BULLETINS.

FREE copies of the following Bulletins are available to Colonial Departments of Agriculture, research institutes and bona fide planters, etc.:—

- No. 1. Sisal Hemp in Fiji, 1911.
3. Rhinoceros Beetle in Samoa, 1912.
4. The Banana in Fiji, 1912.
5. Scale Insect on Bananas, 1913.
6. Lemon Grass, 1913.
7. A Mission to Java for a Coleopterous Pest of Bananas, 1914.
8. Coconut Experiments, 1915.
9. Soils of Fiji—I., 1916.
11. Alluvial Soils of Fiji, 1919.
12. Leaf Moth of Coconuts, 1919.
13. Sea Island Cotton, 1920.
14. Transparent Coconut Scale, 1921.
15. Purple Leaf Moth of Coconuts, 1924.
17. Early Nutfall in Coconuts, 1930.
18. Control of Coconut Spike Moth, 1935.
19. Fruit Fly Investigations, 1936.
21. Biological Control of the Rhinoceros Beetle, 1941. Price 1s.
22. An Introduction to the Mosquitoes of Fiji, 1943.
- Fijian Plant Names, 1942. Price 3s. 6d., 4s. and 6s.

Applications should be made to the Librarian, Department of Agriculture, Suva, Fiji.

—EDITOR.

CONTENTS.

VOL. 17, No. 1, MARCH, 1946.

	PAGE
EDITORIAL—AGRICULTURAL POLICY, SUMMARY OF LEGISLATIVE COUNCIL MOTION <i>by C. H.</i>	1
STATEMENT OF POLICY AND ACTION OFFICIALLY ADOPTED FOR DEPARTMENT OF AGRICULTURE	2
PRELIMINARY REPORT ON RICE GROWING ON GUADALCANAL, BRITISH SOLOMON ISLANDS <i>by E. M. Ojala</i>	7
ENTOMOLOGICAL NOTES <i>by R. J. A. W. Lever</i> —	
1. Some Mites from Fiji	9
2. 666 versus DDT	9
3. An Introduced Beetle Borer from Australia	10
4. A New Type of Damage by the Coconut Spathe Borer, <i>Acritocera neglegens</i>	10
5. The Rice Leaf-Roller, <i>Marasmia venilialis</i>	11
6. Additions and Corrections to Insect Pest Records	11
7. New Insect Pest Records from Tonga and Samoa	12
8. Further Experiments with DDT	13
AGRICULTURAL NOTES <i>by H. R. S.</i> —	
1. Clean Padi Seed for Sowing	16
2. Rice Growing, 1945-46 Season	16
3. Produce	17
4. Eradication of Nut Grass in India	17
REVIEW—	
The Distribution, Status and Control of Noxious Weeds in Fiji	18
NOTES FROM CENTRAL AGRICULTURAL STATION, NADURULOULOU <i>By B. E. V. Parham</i> —	
1. Fodder and Pasture Trials, 2. Kudzu Vine, 3. Sweet Corn	20
BOTANICAL NOTES <i>by B. E. V. Parham</i>	22
EXTRACTS—	
Subsoil Tillage	6
Tuber Sprouting Stopped	6
The Giant Toad in Queensland	19
The Earth's Green Carpet	26
Prevention of Waste in the Use of Grain Bags	29
Kudzu and Soil Erosion—A warning note	30

ERRATA, VOL. 16, No. 4, DECEMBER 1945.

Page 92—In the extract on "Clearing Timber" the word karri (a gum tree) should be substituted throughout for kauri (a pine tree).

Page 96—Ninth line from bottom, for "filed and chemical" read "field and chemical".

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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

VOL. 17.]

MARCH, 1946.

[No. 1

EDITORIAL.

AGRICULTURAL POLICY.

At the February session of the Legislative Council the Director of Agriculture introduced in the form of a motion a memorandum setting out very briefly, first the broad terms of agricultural and land policy, and second, the reorganization requirements and general direction of work of the Department of Agriculture necessary to implement that policy. This memorandum was based on the report of Professor Shephard, that of Professor Paterson and Dr. Dodds and the reports of the Special Committee set up to consider the principal reports; appended to the memorandum were statements of estimated capital expenditure on agricultural stations and of recurrent charges for staff and upkeep. This memorandum in full, as amended in Legislative Council, and summaries of the statements of cost, are reproduced in this issue.

Before the motion was introduced, His Excellency the Governor informed Council that acceptance of the motion would not automatically approve the projected expenditure; the development of the plan would take some years and applications for authority for expenditure would come before the Finance Committee of Council in the usual way.

The memorandum was debated at considerable length, and criticisms of the policy (apart from land tenure, which is not dealt with in this note) were mainly directed to emphasize that the investigational work on agricultural problems to be conducted by the Department must be limited to strictly practical problems, that the extension service should be planned to provide for the ocular demonstration of improved practices to small farmers, and that provision should be made for the sound training of youths in farm practice and theory. Amendments to the memorandum to this effect were accepted.

From the point of view of Departmental organization two of the most important features are, that provision is made for the appointment of an Advisory Committee on Agriculture, and recognition of the necessity for investigational and extension work to be the responsibility of separate branches of the Department.

The Advisory Committee is to include representatives of the major agricultural industries of the Colony. Its purpose is to ensure that the work of the Department is closely co-ordinated with the development and the requirements of the agricultural industries; it is hoped that frequent and regular consultation between the leaders of the agricultural community and the principal officers of the Department will lead into constructive channels the criticism which has so often been levelled at the Department, and that a better understanding of mutual difficulties will be achieved.

The Department has the dual responsibility of investigating local problems and of maintaining an advisory service for the agricultural community. The former usually requires experiments to be carried out either on an agricultural station or in a farmer's fields and demands a concentration of time and effort which places a strict limitation upon the movements of the men engaged on such works; effective extension work, on the other hand,

requires that the staff should move freely amongst the farmers. The recognition of this and of the consequent need for separate teams for the two branches of work, with adequate provisions for co-ordination between the two, should result in a considerable increase in efficiency.

Some time must elapse before the full scheme can be developed; nevertheless the formulation and acceptance of a definite policy together with the gradual strengthening of the Department will enable the latter to play its part more effectively in the development of the Colony.

STATEMENT OF POLICY AND ACTION OFFICIALLY ADOPTED FOR DEPARTMENT OF AGRICULTURE.

PART 1.—POLICY.

Object of Agricultural Development.

1. The ultimate goal of any plan for the development of agriculture throughout the Colony is the attainment of a progressively higher standard of living by the people of the Colony.

Plan of Development.

2. To achieve this object such a plan must provide for—

- (a) the preservation of the land and other natural resources; in particular the conservation and improvement of soil fertility;
- (b) the improvement and encouragement of food crops and livestock to secure the optimum nutrition of the people;
- (c) the efficient production of raw materials for export and for local secondary industries.

Function of Agricultural Department.

3. It is the function of the Department of Agriculture to further such a policy and the Department should be so organized and equipped both as regards men and materials that it can make an effective contribution thereto.

Agricultural Department to carry out investigational programme.

4. To enable the Department to play its role as indicated in paragraph 3 the Department must be in a position to—

- (a) undertake an experimental and investigational programme including soil reconnaissance, such programme to be limited to the acquisition of facts necessary to the efficient conduct of practical instruction in agriculture and of extension work amongst farmers;
- (b) with the assistance of the knowledge and experience gained through (a), to promote improved systems of land usage and the more efficient production of crops and livestock through the instruction and education of the farming public, the provision of improved types of planting materials and livestock, and the application of protective measures against pests and diseases.

Investigation and Field work to be co-ordinated but separate.

5. The two main activities of the Department as expressed in paragraph 4 must be maintained as separate branches of the Department and at the same time be closely co-ordinated by a competent administrative staff.

Limits of experimental work.

6. The experimental and investigational programme should be limited to work on practical problems of immediate importance. Fundamental work on long range problems is outside the scope of the Department's activities.

Land Tenure.

7. The management of Crown Land should provide for—
 - (a) security of tenure by the tenant such as to encourage good farming; and
 - (b) the maintenance and increase of the productive capacity of the land.

PART 2.—ACTION PROPOSED.

A programme of action to implement the policy outlined in Part 1 of this Memorandum is proposed.

Principal Agricultural Station.

8. The establishment of a Principal Agricultural Station in the wet zone of Viti Levu, within easy reach of Suva, covering an area of 500 to 800 acres and embracing the principal arable soil types of the zone and a proportion of hill land.

9. The establishment at the Principal Agricultural Station of the biological laboratories of the Department.

10. The establishment of an agricultural station in the dry zone of Viti Levu within easy access of Lautoka covering 250 to 300 acres of the poor to medium soils of the agricultural and pastoral lands of the dry zone and the establishment at this station of the Headquarters of the Western Viti Levu staff.

*Vanua Levu Station.**

11. The establishment of an agricultural station on Vanua Levu within easy reach of Labasa covering an area of 100 to 150 acres to be used mainly as a stock, seed, and demonstration farm.

Existing Stations.

12. The maintenance of the existing station at Sigatoka as a stock, seed, and demonstration farm under the control of the dry zone Agricultural Station.

13. The abandonment of all the existing agricultural stations subject to—

- (a) the maintenance of the Sigatoka Station as indicated in para. 12;
- (b) the maintenance of the existing nurseries and plantations at the present Central Agricultural Station at Naduruloulou if incorporation with the new principal station proposed in para. 8 is possible;
- (c) the maintenance of the sub-station at Dobuilevu, Ra, as a district farm.

Soil Survey.

14. The carrying out of a soils reconnaissance survey of the Colony in order to establish the extent, distribution and characteristics of the principal soil types.

Field Extension Work.

15. The Department of Agriculture—

- (a) to undertake a comprehensive programme of extension work in and particular to undertake the co-operative demonstration of improved practices on the farms of progressive farmers;
- (b) to establish two small demonstration farms in areas not served by the agricultural stations;
- (c) to make extended use of the *Agricultural Journal*, leaflets, and articles to the press; and
- (d) the appointment of a weeds inspector to have a similar status to that of the Produce Inspector as recommended by the Noxious Weeds Committee in Council Paper No. 35/1945.

Agricultural Education.

16. The appointment of an Agricultural Education Officer whose duties will be to give instruction to the students of the Teachers' Training College and the subordinate staff of the Department, and the early development at the Principal Station of a Farm Institute.

Marketing.

17. The appointment of a Marketing Officer whose duties will be—

- (a) to promote the marketing of smallholders' produce;
- (b) to encourage the development of co-operative marketing;
- (c) to explore possible new markets for established or potential agricultural industries.

Co-operation with agricultural industry.

18. The establishment of a standing advisory committee on agriculture, which would be representative of the major agricultural industries of the Colony, in order that the direction of the work of the Department of Agriculture should be co-ordinated with the agricultural and general development of the Colony.

Western Pacific.

19. The services of the agricultural administrative and specialist officers listed under Subhead 1 of Appendix II to this memorandum to be made available to the Western Pacific High Commission Territories for advice and assistance subject to the Western Pacific High Commission Territories bearing two-fifths of the cost of salaries, travelling expenses, pensions and other charges.

Land Tenure.

20. The application of the following principles and procedures in the leasing of Crown Land for agricultural purposes—

- (a) the maintenance of control over dealings in leases, including the encumbrance of leases;
- (b) the adoption of a 30-year term for leases with provision that the lessee will normally be granted an extension for a further period of 15 years at the end of every 15th year on the same conditions: provided there has been no breach of the covenant of the lease and provided further that renewal may be refused if the land is required by Government;
- (c) the reassessment of rental at the end of every 15th year of a 30 year lease: provided that there shall be no reassessment during the initial period of 30 years;
- (d) the termination of any lease whenever the lease conditions are not observed;
- (e) in the case of refusal to extend a lease, the lessee to be paid compensation for all unexhausted improvements on or to the land, less the value of dilapidations: provided that the prior and written consent of the landlord shall have been obtained for permanent or long term improvements such as dwellings and farm buildings of substantial construction, wells, fences, drainage and irrigation systems, anti-erosion structures;
- (f) where the assessed value of dilapidations exceeds the assessed value of unexhausted improvements on or to the land at the date of expiry the outgoing lessee to be liable for payment of the difference;
- (g) on the death of a lessee the lease to pass to the lessee's estate.

PART 3.—COST.

21. The estimated cost of the establishment and equipment of the agricultural stations and of the soil survey is shown in Appendix I. No provision is made for quarters, the cost of which will be met from a general vote for housing for civil servants.

APPENDIX I.

REORGANIZATION OF THE DEPARTMENT OF AGRICULTURE.

Estimated Capital Cost of Proposed Agricultural Experiment Stations.

1. Principal Agricultural Station, Eastern Viti Levu—			
(1) Offices and Laboratories	£12,000		
(2) Farm Buildings	5,000		
(3) Power and Water	3,000		
(4) Cold Storage Equipment	500		
(5) Farm, Dairy and Laboratory Equipment, vehicles	6,500		
(6) Cocoa Propagators—nursery	1,500		
(7) Fencing	1,500		
(8) Purchase of land for station.	19,000		
(9) Roads—			
Access roads	4,500		
Estate roads	1,000		
(10) Livestock	3,000		
(11) Telephone—Installation to offices and principal residences	750		
			£58,250
2. Agricultural Station, Western Viti Levu—			
(12) Office, Surgery, etc.	2,500		
(13) Farm Buildings	2,500		
(14) Power and Water	1,000		
(15) Farm Equipment and vehicles	4,500		
(16) Fencing	1,000		
(17) Purchase of Land	5,000		
(18) Roads—Site of Station uncertain; say	500		
(19) Livestock	3,000		
(20) Telephone installation	200		
			20,200
3. Agricultural Station, Vanua Levu—			
(21) Administration Office, Surgery, etc.	750		
(22) Farm Buildings	1,000		
(23) Power and Water	250		
(24) Farm Equipment and vehicles; copra driers	2,000		
(25) Fencing	300		
(26) Purchase of Land	1,500		
(27) Roads—Site of Station uncertain; say	300		
(28) Livestock	500		
(29) Telephone	100		
			6,700
4. District Farms—			
(30) Purchase of land and equipment for two district farms			2,000
5. Soil Survey—			
(31) Reconnaissance Soil Survey of Fiji			5,000
Grand Total			£92,150

APPENDIX II (SUMMARIZED).

A.—FIJI AND WESTERN PACIFIC HIGH COMMISSION.

1. Personal Emoluments—

	1946 <i>Estimates</i>	<i>New Estimates</i>
Administrative	£2,423	£4,200
Specialist	1,680	3,480
Technical	662	1,000
House and acting allowances	284	519
Travelling and other charges	680	2,750
		£11,955
Less contribution from W.P.H.C.		4,782
	£5,729	7,173
B—EXTENSION AND STATION SERVICES, FIJI—		
Personal emoluments and sundries	£13,784	£18,330
Travelling, field work and other charges	15,115	16,860
	£28,899	35,190
Grand total, 1946 estimate	34,628	
Grand total, new estimate		47,145
Less contribution from W.P.H.C.		4,782
		£42,363

EXTRACTS.

SUBSOIL TILLAGE.

TURNING the soil over by plowing it is coming to be recognized as bad farm practice. Recognizing this fact, two of America's largest farm-implement companies have introduced an entirely new tillage device which consists of V-shaped cutters that run a few inches below the surface, pulverizing the soil and cutting off all weed growth. All the rubbish and plant residues, however, remain as a mulch on top of the soil to protect it from the compacting forces of rain and snow, and at the same time they prevent its drying out. These new cultivators will cover a much greater acreage per day, and require much less tractive power to pull them.

—*Rotarian*, January 1946.

TUBER SPROUTING STOPPED.

IN the past a large annual loss has resulted from the sprouting of vegetables in storage—especially potatoes. A University of Wisconsin scientist has finally found a chemical which will prevent this premature sprouting. It is the methyl ester of alphe-naphthalene acetic acid, and has been known for some time to exert a hormone action on plant growth. As little as three ounces of this chemical is sufficient to treat 100 bushels of "spuds" and keep them from sprouting. It may be applied as a dust, as a spray of the solution, or as an emulsion.

—*The Rotarian*, August 1945.

PRELIMINARY REPORT ON RICE GROWING ON GUADALCANAL, BRITISH SOLOMON ISLANDS.

By

E. M. OJALA, M.Agr.Sc.

THIS general account of experience in growing rice on a grassland-plains soil of Guadalcanal, British Solomon Islands Protectorate during the 1944-45 season will be described in two parts:—

- (a) Replicated Trial;
- (b) Field Observations.

(a) REPLICATED TRIAL.

This trial was conducted by the randomised block method using eight blocks, each block consisting of five 4-row plots, i.e. one plot of each of the five varieties under test.

These varieties were:—China Patna; B.G. 75; B.G. 79; Ram Cajara; New Guinea.

The plots were located at random in each block. Plots were two chains long but ends were discarded for trial purposes, only 128 feet of each plot being measured for yield. Rows were 14 inches apart, and the two outside rows of each plot were discarded for yield purposes in order to eliminate "outside row" effect. Thus the actual area of the plot measured for yield was 128 feet by 2 feet 4 inches in each case.

The trial was sown on 9th December, 1944, using a four-row "Planet Junior" seeder drawn by a tractor, and a good strike was obtained. Growth was fast and uniform thereafter except that two blocks were attacked by caterpillars in January 1945 but recovered after a dusting with Paris green.

Each variety was harvested when mature but there was little variation in the period required for maturation. B.G. 75, B.G. 79 and Ram Cajara took 140 days, New Guinea five days longer and China Patna a further ten days.

The results of this trial are tabulated below. The figures refer to dry padi winnowed. One bushel is taken as 48 lb padi.

Variety.	Actual yield in lb (Av. of 8 plots).	lb per acre.	Bushels per acre.
B.G. 75	33	4,810	100
Ram Cajara	28½	4,190	87
B.G. 79	28	4,080	85
New Guinea	22	3,210	67
China Patna	17½	2,540	53

These results have not been examined statistically to determine whether the differences between varieties are significant. However the general level of the yields is encouraging.

(b) FIELD OBSERVATIONS.

These were conducted with six varieties, namely the five mentioned above and also Sonacalif. The areas were all sown on the 9th December, 1944, except that a small field of New Guinea was sown on the 10th December.

The rates of seeding were as follows:—

B.G. 75	..	..	..	12	lb per acre
Ram Cajara	..	..	..	13½	"
B.G. 79	..	..	..	11	"
New Guinea	..	..	..	14	"
China Patna	..	..	..	12½	"
Sonacalif	..	..	..	14	"

A good strike was obtained with every variety except Sonacalif which was a very open stand due to poor germination. Harvesting was done by natives using sickles.

The results obtained are shown in the following table:—

Variety.	Area in in acres.	Actual yield in lb.	Bushels per acre.
B.G. 75	1.00	3,808	80
China Patna	1.70	5,418	66
B.G. 79	0.41	1,307	66
Ram Cajara	0.48	1,408	61
Sonacalif	0.80	1,704	44
New Guinea	0.70	1,000	30

NOTES ON VARIETIES.

Sonacalif matured in 128 days.

New Guinea cropped heavily, but was harvested slightly past maturity and much grain was lost because the heads broke up when handled. This variety also was most susceptible to damage by a stem-boring caterpillar.

China Patna yielded better in the field than in the trial. The probable reason for this is that it was sown in the wettest corner in the field.

Lodging: *Ram Cajara* and *G.B. 79* both lodged very badly, *Sonacalif* and *B.G. 75* lodged fairly badly, *New Guinea* slightly and *China Patna* hardly at all. From this point of view the two last-named varieties would no doubt be most suitable for plantings intended for harvesting by machinery.

GENERAL NOTES.

Land.—The rice was grown on an area typical of thousands of acres to be found on the grass plains on Guadalcanal. This particular area was broken out of the virgin grass in June 1944, and sown in maize by the U.S. Army, the rice succeeding this maize crop.

Fertilizer.—No fertilizer was sown with the rice, but the Americans had used 400 lb of complete fertilizer and 200 lb sulphate of ammonia per acre with the corn.

Irrigation.—There was no irrigation but small banks were made to impede run-off.

Rainfall.—The rainfall recorded at Henderson Field (about six miles distant) during the five months December 1944, to April 1945, covering the growing period of the crop, amounted to 50 inches.

Pests and Diseases.—An army of caterpillars threatened to defoliate completely the young rice in January but the invasion was readily dealt with by dusting with Paris green.

Stem-boring caterpillars were present in all varieties, affecting only the portion of stem above the top-most node. The infestation was not serious. As mentioned above *New Guinea* variety seemed to be most susceptible.

Yellowing of the tips of the leaves began to appear in the *New Guinea* rice in March but a spell of very wet weather completely halted this development which did not re-appear.

SUMMARY.

Experience gained in the one season 1944-45 indicates that good yields of rice may be obtained on the plains of Guadalcanal using machine methods of cultivation if the crop is sown in the early part of the rainy season which begins in December.

ENTOMOLOGICAL NOTES.

By

R. J. A. W. LEVER, B.Sc., D.I.C., A.I.C.T.A., F.I.S.,
Entomologist.

1. SOME MITES FROM FIJI.

In 1939 ⁽¹⁾ a note published on a mite from a sample of copra sent from Levuka used, on the advice of a systematist, the name of *Caloglyphus mycophagus* Megrin. In a paper published in 1941 ⁽²⁾, but seen only recently it appears that this record should be *C. berlesi* (Michael) and this correction is now made.

This opportunity is taken of listing the local mites though it is not claimed to be complete as references are scattered throughout many technical journals.

The most obvious mite damage is seen in garden hibiscus, the leaves of which are often puckered as a result of attacks by a species of leaf blister mite or gall mite *Eriophyes hibisci* Nalepa in whose galls is also found the flattened mite *Oxypleurites bisetus* Nalepa.

Other mites of crops are the coconut leaf mite or "red spider", *Tetranychus fijiensis* Hirst, and the bulb or Eucharist mite, *Rhizoglyphus echinopus* Fum. and Robin from sweet potato tubers. The tropical fowl mite, *Liponyssus bursa* Berl. is found on poultry and pigeons and a species of *Fuscuropoda* in bat guano. The writer's thanks for identifications are due to Mr. H. Wormesley of Adelaide who is describing a new species of *Trombicula* taken from a bat (*Emballonura* sp.) from Lakeba, Lau.

REFERENCES.

- (1) Lever, R. J. A. W.—1939. *Agric. Jour. Fiji*, Vol. 10, No. 4, November, p. 126.
- (2) Wormesley, H.—1941. *Rec. S. Aust. Mus.*, Vol. VI, No. 4, pp. 461–463.

2. 666 VERSUS DDT.

SINCE publication of the December issue of the *Agricultural Journal* further details have come to hand of the effects of gammexane or 666 against various insect pests.

In an article published in *Endeavour* for October 1945 (Vol. IV, No. 16) Dr. R. E. Slade gives results of the relative efficiency of 666 and the more widely publicised DDT which may be summarised as follows:—

Insect.	Conditions of test.	666	DDT.
Grain weevil	50 per cent kill after 5 days.	1 part.	15 parts.
Laræ of yellow fever mosquito.	Mortality after 2 days at $\frac{1}{10}$ lb of insecticide per acre.	27 per cent.	43 per cent.
Migratory locust	Mortality after 2 days in a poison bait.	62 "	57 "

It is of importance to note that 666 (666 used at 1/10 strength of DDT) in addition to its greater toxicity (it is the most powerful insecticide known) causes little or no harm to plants, animals or man, which cannot be said for DDT.

Trials of gammexane against insect pests of plants will be carried out in the Colony as soon as this material is received and it may arrive about the same time as the new weedicide methoxone which is to be similarly tested against our noxious weeds.

3. AN INTRODUCED BEETLE BORER FROM AUSTRALIA.

GRUBS and pupæ of a Longicorn beetle were forwarded in June 1945, from Lautoka where they had been taken under the bark of "turpentine tree" logs imported from Australia for use as wharf piles.

In the following September the writer collected live larvæ, pupæ and adults from the timber and, hearing that another shipment was expected from New South Wales, had further specimens collected on board on the vessel's arrival at Suva.

The beetle was subsequently identified by the Imperial Institute of Entomology, London as *Phoracantha semio* Newm. There is a number of species of this genus in Australia where they are referred to as "firewood beetles" (1) on account of their being introduced into houses in firewood. It is of interest that an Australian and Papuan species, accidentally introduced into New Zealand and South Africa, causes damage by the full-fed larvæ cutting shafts through the sap wood into the solid wood several inches below the bark where they fed as young larvæ (2).

In an earlier work (3) the same writer, as well as Tillyard (1), mentioned *Phoracantha* as pests of gum trees but the so-called "turpentine tree" (*Syncarpia laurifolia* Ten.) is a myrtle; its resin is said to protect it from borers (4) but this now appears doubtful.

The writer is obliged to the Collector of Customs, Lautoka for having sent the specimens of this insect, a newcomer which it is hoped can be kept under control by applications of creosote or tar to the logs.

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- (2) Froggatt, W. W.—1923. "Forest Insects of Australia", p. 36.
- (3) Ditto—1907. "Australian Insects", Sydney, p. 192.
- (4) Audas, J. W.—1937 (?). "Native Trees of Australia", Melbourne, p. 130.

4. A NEW TYPE OF DAMAGE BY THE COCONUT SPATHE BORER, *ACRITOCERA NEGLEGENS*.

THE cream-coloured beetle-like caterpillar of the moth *Acritocera neglegens* Butl. was first recorded in Fiji by Jepson (1) from coconut spathes on Taveuni. The fleshy, legless larvæ has powerful mandibles and brown thoracic and anal shields, the latter being pointed. Jepson very naturally referred to it as a spathe-boring beetle larva, but Simmonds (2) showed it to be the larva of a large brown moth and also referred to it as attacking the unopened spathes through which the larvæ tunnel.

A still more recent worker to deal with *Acritocera* was Taylor (3) who substantiated Jepson and Simmonds by showing the larva was found in the spathes and flower branches and these were the only sites where it had been seen by the writer until this year.

During January 1946, the writer's attention was drawn by the Agricultural Officer, Southern, to some affected palms at Tailevu and examination disclosed galleries filled with the typical pinkish-brown frass in the expanded leaf butts and larvæ of *Acritocera* were found in this most unexpected site. Taylors' observation (3) that the economic importance of this insect is slight will now have to be revised as the damage in certain cases weakened the leaf butts which support the fruiting branches on which the nuts are borne.

As the eggs are laid by night on the fibrous leaf stipules or "vulu" it is remarkable that this new type of injury has not been recorded before.

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- (1) Jepson, F. P.—1911. Council Paper No. 25, Fiji, p. 44.
- (2) Simmonds, H. W.—1924. *Agric. Circ.* Fiji, Vol. 5, No. 1, January–June, pp. 54 and 67.
- (3) Taylor, T. H. C.—1930. Bull. No. 17, Dept. of Agric. Fiji, pp. 8–11.

5. THE RICE LEAF-ROLLER, *MARASMIA VENILIASIS*.

IN February and March 1944, reports of a new leaf-mining caterpillar on rice were received and specimens were subsequently sent from Waitavala (Taveuni), Labasa (Vanua Levu), and subsequently from Ovalau Island.

The green caterpillar damages the leaf which is rolled into a tube in which the larva subsequently pupates. A white streak is caused by its feeding, giving a characteristic appearance to a field damaged by this pest.

The insect was provisionally determined as *Marasmia venilialis* Wlk. and this was subsequently confirmed by the Imperial Institute of Entomology, London. It is of interest to note that it was not included when reviewing local rice pests in 1939 ⁽¹⁾ though the same or a closely allied species was recorded in New Guinea on rice leaves in that year ⁽²⁾. In Samoa it occurs on *Paspalum conjugatum*, Job's tears and other grasses ⁽³⁾.

Other plants on which the larvae of this moth had previously been taken in Fiji are Para grass (*Brachiaria mutica*) and *Alternanthera sessilis* R. Br. ⁽⁴⁾ and it is interesting to find this moth—which occurs in India, Ceylon, Burma and the Philippines ⁽⁵⁾ and Australia, Borneo, Guam and the Solomons ⁽³⁾—suddenly reaching pest proportions in all or nearly all the rice-growing regions of the Colony especially as it is said in India to be scarcely a pest, probably feeding normally on wild grasses ⁽⁵⁾. Control there recommends cutting off the affected tips which are fed to stock, weeding of the bunds and light traps at night. Experiments for the control of the inaccessible larvae will be made during the present season with 666 and DDT but the above notes on its history and biology are presented here for reference.

Preliminary tests show that one per cent DDT sprays are very promising on a small scale.

Light parasitism by an Ichneumon (*Cremastus* ?) and a chalcid was noticed at Naduruloulou.

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- (2) Froggat, J. L.—1939. *New Guinea Agric. Gaz.* Vol. 5, No. 1, March, p. 16.
- (3) Swezey, O. H.—1941. *Hawaiian Sugar Planters' Rd.* Vol. 45, No. 1.
- (4) Greenwood, W.—1929. *Proc. Linn. Soc. N.S.W.* Vol. 54, Pt. 4, p. 345.
- (5) Fletcher, T. Bainbridge—1921. *Bull.* 100, Pusa, India, p. 82.

6. ADDITIONS AND CORRECTIONS TO INSECT PEST RECORDS.

IN March 1937, a robust Indian pupal parasite of fruit flies introduced from Hawaii was recorded ⁽¹⁾ as an unknown *Dirhinus*. As it has not the value of the smaller *Tetrastichus giffardianus* Silv., mass breeding was discontinued in 1943. This Indian parasite has recently been determined by Mr. C. Musebeck of the United States Department of Agriculture, Washington, as *Dirhinus giffardii* Silv. ✓

In September 1941, there was heavy, if localised, damage at Waimaro to leaves of dilo (*Calophyllum inophyllum* L.) by an orange-pink caterpillar. The moths reared from these were identified in November 1945 by the Imperial Institute of Entomology as *Stictoptera subobliqua* Wlkr., apparently the first record of this genus, of which there are at least five other local species, as a pest.

The well known bamboo-boring beetle *Dinoderus minutus* F. was twice recorded ⁽²⁾ and ⁽³⁾ as a pest of *Schizostachyum glaucifolium* Munro, but it is clear that the bamboo used for building native type houses is a species of *Bambusa* and this therefore is the host of the borer. This correction was kindly given to me by Mr. W. Greenwood of Lautoka.

In dealing with the large *Periplaneta* cockroaches in 1943⁽⁴⁾ the writer erroneously recorded the Chalcid *Tetrastichus hagenowii* (Rat³) as an egg parasite. This insect is actually a hyperparasite of the cockroach egg parasite *Evania* or "ensign flies" of which four species are locally recorded viz. *E. impressa* Schlott, *E. subspinosa* K., *E. sericea* Cam. and *E. appendigaster* (L.). It is of interest to note that *T. hagenowii* was described from Europe as long ago as 1852 and is now widely distributed⁽⁵⁾.

REFERENCES.

- (1) Simmonds, H. W.—1937. *Agric. Jour. Fiji*, Vol. 8, No. 3, July, p. 23.
- (2) Lever, R. J. A. W.—1940 *Ibid.* Vol. 11, No. 2, June, p. 39.
- (3) Ditto.—1943. *Ibid.* Vol. 14, No. 3, Sept., p. 83.
- (4) Ditto.—1943. *Ibid.* Vol. 14, No. 2, June, p. 41.
- (5) Williams, F. X.—1931. "Insects and other Invertebrates of Hawaiian Sugar Cane Fields". Honolulu, p. 356.

7. NEW INSECT PEST RECORDS FROM TONGA AND SAMOA.

THE chief insect pests of Tonga were dealt with⁽¹⁾ in the annual report for 1940 by the then Director of Agriculture of that Kingdom and are shown, as would be expected, to be mostly species also found in Fiji.

During a very brief visit in February 1946, the writer found the characteristic crinkled and wavy margined leaves of bananas symptomatic of "bunchy top". This virus condition is caused by attacks of the aphid *Pentalonia nigronervosa* Coq. found in Fiji, Ceylon and Queensland but hitherto unreported from Tonga. The only remedy is eradication and burning of the plants.

Readers of the interesting pamphlet "Pacific Story"⁽²⁾ will remember reference therein to the plague of caterpillars which "demolished every blade of grass" on the aerodrome at Fuamotu, Tongatapu thereby preventing a brigadier from landing for an inspection. These insects were sent to the writer for identification in May 1941, and were found to be the cutworm *Spodoptera mauritia* Bois., a common pest of rice, maize and Para grass in Fiji. The Tongan specimens were parasitised by two Braconids, one of which was a species of *Macrocentrus*.

The cucumber and pumpkin beetle referred to⁽¹⁾ as *Aulacophora* sp. is *A. similis* Olliv.; it was taken by the writer on those crops in New Caledonia New Hebrides and the Solomons last July as well as on sweet potato leaves on Guadalcanal, Solomons and on leaves of water melons at Vavau, Tonga.

Probably no other tropical islands of comparable size have had their insect fauna more thoroughly described than Samoa, thus Swezey^(3 and 5) and Hopkins⁽⁴⁾ dealt with pests of economic plants, Buxton's and Hopkin's excellent researches⁽⁶⁾ on insects of medical importance while the "Insects of Samoa" series, published by the British Museum (Natural History) between 1927 and 1935, gives systematic details of all the known insects.

The writer was therefore somewhat surprised during a two and a half days' visit to the northern coast of Upolu Island to find the teak leaf-roller *Hyblæa puera* Cram. doing damage to young teak leaves on a cocoa estate. Neither Swezey nor Hopkins recorded this insect in their visits of 1923-25 and 1940 though it had been taken on Tutuila, American Samoa in 1923⁽⁷⁾. It is known in Fiji from teak, *Clerodendron inermis* R. Br. and *Vitex trifolia* L. but does not appear to reach pest proportions in this Colony. It has orange-red hind wings with black markings.

The American mud-dauber, a long legged, thread-waisted, black and yellow "wasp", *Sceliphron cæmentarium* (Drury), was also taken in February 1946. This again was not collected by Buxton⁽⁸⁾ which is not surprising as

it was not recorded in Fiji till 1939⁽⁹⁾ the writer then omitting to include the Marquesas and Society Islands⁽¹⁰⁾ in its distribution.

This insect stuffs the cells of its nest with spiders. The enormous amount of shipping in the Pacific between 1942 and 1945 would readily account for its arrival in Samoa and it is no doubt also now established in other unrecorded islands as the mud cells are readily transported on packing cases or stores.

Finally, the adult rhinoceros beetle (*Oryctes rhinoceros* L.) in Samoa appears generally to carry small mites on its body similar to the local dung beetle, *Copris incertus procideus* (Say). The identification of these mites is awaited as is a red *Celanopsis* found on the coconut leaf Hispid beetle *Brontispa longissima* in the Solomons.

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- (2) Anon.—1945. "Pacific Story"—Wellington, p. 17.
- (3) Swezey, O. H.—1924. *Proc. Haw. Ent. Soc.*, V, 3, December, pp. 385-393.
- (4) Hopkins, G. H. E.—1927. *Bull. Ent. Resch.* 18, 1, pp. 23-32.
- (5) Swezey, O. H.—1941. *Haw. Planter's Recd.* 45, 1, pp. 25-38.
- (6) Buxton, P. A. with Hopkins, G. H. E.—1927. "Researches in Melanesia & Polynesia". London School of Hygiene & Tropical Medicine.
- (7) Tams, W. H. T.—1935. "Insects of Samoa" Part 3, Fasc. 4, p. 237.
- (8) Perkins, R. C. L. and Cheesman, L. E.—1928. *Ibid.* Part 5, Fasc. 1, pp. 26-28.
- (9) Lever, R. J. A. W.—1940. *Agric. Jour. Fiji.* Vol. 11, No. 2, June, p. 41.
- (10) Cheesman, L. E.—1928. *Ann. & Mag. Hist. Ser.* 10, Vol. 1, pp. 171-172.

8. FURTHER EXPERIMENTS WITH DDT.

EARLY in 1944 in the *Agricultural Journal* a brief account⁽¹⁾ was given of the uses of DDT in diesel oil as a mosquito larvicide and later⁽²⁾ as a dust against the Indian rose beetle *Adoretus versustus* Har.

In view of the interest and importance of this new insecticide further results obtained during the last six months are given of its use against mosquito larvæ in water, domestic insects and also against plant pests.

MOSQUITO LARVÆ.

A perennial source of mosquito breeding was a concrete cable tank holding 35,000 gallons which when filled with sea water was selected for oviposition by *Culex sitiens* Wied. and when it contained fresh water was chosen by *C. fatigans* Wied. Material for lids being unprocureable and application of chemicals and kerosene (in the normal amounts necessary) being regarded as harmful to the cables it was decided to use a five per cent solution of DDT* in benzene, two quarts of the fluid being mixed with three gallons of water and sprayed on the surface. Applications were found to be effective from 12 to 14 days so that a routine spraying every two weeks is now carried out and prevents pupation taking place. Eggs laid were infertile. A five per cent solution in diesel oil absorbed by sawdust and suspended in a bag in a disused salt water swimming bath which cannot be properly drained had a similar effect in preventing breeding of *C. sitiens*. Lengths of twine hanging down from necks of bottles which were suspended clear of the water surface also gave good results but were prone to tampering.

In order to test if there was any specific variation in the rate of mortality, tests were made in glass jars using a higher concentration (10 cc. of five per cent DDT in diesel oil in three quarts of water) than in the field in order to get results in four hours. It was found that larvæ of *Culex annulirostris* Skuse always succumbed before *C. fatigans* Wied; followed by *Aedes vexans* Meig; *A. scutellaris pseudoscutellaris* Theob. and *A. ægypti* L. as the last to show movement.

* DDT kindly provided by the Company concerned, Cable and Wireless Ltd.

HOUSEHOLD INSECTS.

During 1943 and 1944 at a wireless direction finding station on the coast, serious irritation to its personnel was caused by sandflies (*Culicoides mollis* Edw.) which readily flew through the mosquito-proof wire gauze. A five per cent solution of DDT in diesel oil sprayed on these gauze panels and surrounding woodwork resulted in a marked reduction in the sandflies with a consequent alleviation to the observers. There was also a noticeable repellent or residual effect for three weeks following spraying in December 1944.

Dusting hair with Neocid (five per cent DDT) was found to check head lice (*Pediculus humanus* Degeer) in heads of Indian school girls. Application was made by rubbing the powder over the scalp with pieces of cotton wool, the eyes being covered; oiling of the hair was not to be done for three days. After a period of 3½ months there were only 36 cases of reinfestation out of 196 girls which is regarded as satisfactory over such a relatively long period.

Reports from a District Medical Officer, to whom a supply of DDT was forwarded, showed that used as a normal five per cent spray in benzene there was effective control of bed bugs (*Cimex hemipterus* F.) in beds in the dormitory of a girl's hostel.

Fleas are periodically a nuisance being usually worse on lawns than inside houses; the species is *Ctenocephaloides felis* Bouché. Control was given by (i) five per cent DDT in fine road dust and (ii) five per cent DDT in kerosene, the latter being more effective and having a marked diminution in numbers of the fleas which jumped on to the ankles of persons walking on the lawn. Previous attempts at control (not by the author) with kerosene emulsion and Black Leaf 40 were unsuccessful. Dusting Neocid from a knapsack duster also controlled cat fleas, in a public building in Suva.

Less decisive results were at first obtained against the large cockroach (*Periplaneta americana* F.) in dwelling-houses but the usual five percent solution in diesel oil gave excellent control against large swarms in a concrete pit in a soap factory. This insect well shows the effect of DDT on the nervous system with the typical "drunken" gait accompanied by inco-ordinated movements and violent tremors. Although death did not follow till up to 23 hours after spraying the cockroaches were all on their backs in a few hours with twitching of legs, antennæ and the anal processes. Good results were also obtained with Neocid against the German cockroach *Blatella germanica* L. in a hospital kitchen.

Next to mosquitoes the insect studied most thoroughly in its reaction to DDT is the housefly and many reports have appeared dealing with the number of minutes elapsing after contact with various surfaces (sprayed with solutions of so many milligrammes per square foot) before the flies fell and died.

It was decided instead to make local tests under the conditions likely to be of use to the ordinary householder and application of a fine film of five per cent DDT in benzene to cages with glass sides and wire gauze showed that all flies dropped after 25 minutes and were dead in 2½ hours. The Pacific Island house fly is *Musta domestica* L. *vicina* Macq. and windows sprayed with the above solution were effective in killing flies up to 10 weeks afterwards.

Finally, hopeful results are looked to in the control of the book and leather borer (*Catorama herbarium* Gorb.) but final details are not yet to hand as a repellent effect must last for several months to be of any use. Carbon tetrachloride is being used as a solvent, DDT being six times as soluble in it as in kerosene.

PLANT PESTS.

Following satisfactory dusting with DDT against the Indian rose beetle *Adorelus versutus* (2) it became possible in 1946 to attempt DDT spraying. It will be realized that it is out of the question to use kerosene or diesel oil against living plants and as DDT is insoluble in water (more accurately 0.2 part per million) one must have some harmless solvent subsequently diluted which is then sprayed on the foliage. Suspensions of DDT in water have given good results until washed away by rain. In mid-February, spraying of DDT in a commercial emulsifying agent and spreader caused slight scorching of rice when used at the strength of one ounce of DDT in five fluid ounces of the spreader in three gallons of water but gave good control of the leaf-roller *Marasmia venilialis* Wlk. No scorching occurred on egg plants using two fluid ounces of the fluid in three gallons in water.

Later, one ounce of DDT dissolved in two fluid ounces (58 millilitres) of xylol was made up to 50 fluid ounces or 2½ pints of water and used on bean plants against *Nacoleia diemenlis* Guen. giving control and again causing no scorching. Similar strengths using the same proprietary emulsier caused no injury to tomato foliage.

As a matter of interest the rainfall at Suva Point during the two months January and February 1946, totalled 30.52 inches while 7.51 inches fell on 26th February in Suva town.

RECOMMENDATIONS AND CONCLUSIONS.

It is suggested that the experiments just described show that DDT is suitable in tropical islands for use against both household and garden insect pests. Care is required to ensure that the bare skin does not come into contact with DDT in solution in any solvent (such as kerosene, benzene or diesel oil) and that access to the pure DDT is not possible by other than trained designated personnel as in this form it is toxic.

Despite accounts in the press elsewhere of its injury to tomatoes, onions, beans and cucurbits (pumpkins, cucumbers, marrows, etc.) these local experiments show that at correct strengths (1 to 2 per cent) there is no injury to plants and this appears to be confirmed in New Zealand for cabbages, apples and carrots; in Australia for beet, maize, potato, cotton and onions and especially in St. Lucia, British West Indies for a wide variety of tropical crops including beans, peas, cabbage, sweet potatoes, tomatoes, egg plant and cucurbits (3).

It is regrettable that results of careful trials by research workers invariably fail to get the same publicity as more sensational accounts of fish and prawns being killed in streams and retardation of growth in certain vegetables.

DDT has its limitations and if it is realized that it does not kill most insect eggs and that its effect on cockroaches is much slower than on flies, mosquitoes and bed bugs one can anticipate good results provided it is used at the recommended strength.

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- (2) ditto—1945. *Ibid*, Vol. 16, No. 4, pp. 102-103.
- (3) Fennah, R. G.—1945. *Tropical Agriculture*, Vol. 22, No. 12, pp. 222-226.

AGRICULTURAL NOTES.

1. CLEAN PADI SEED FOR SOWING.

It is the common practice amongst rice growers and others to winnow their seed padi by hand before planting but it is not realized that no matter how carefully the work is done, a lot of the heavier seeds of many weeds will fall amongst the seed padi to be resown at sowing time and infest the field to the detriment of the young padi. In the control of noxious weeds, the use of clean seed at sowing time is of the utmost importance for it should be obvious that to resow weed seeds is to add to the labour costs of producing the crop.

A method whereby seed padi may be freed from weed seeds and other foreign matter up to 100 per cent purity is by passing the seeds through a mechanical winnower.

Such a machine, known as the "Little Wonder" winnower, manufactured by Robertsons of Melbourne, Australia, was imported by this Department in 1943 and after a highly satisfactory trial with maize at the Produce Inspection Store in Suva, it was forwarded to the General Experiment Station, Sigatoka where its efficiency in cleaning padi and freeing it from weed seeds, was fully demonstrated. As a result of this, the Supply and Production Board ordered six more machines in 1944, three of which were received late in 1945. One was stationed at the Central Agricultural Station, Naduruloulou and one at the Doboilevu Demonstration Farm, Ra. In December last the efficiency of this machine was demonstrated to 15 Indian farmers of the Vunikabikaloa settlement and to 10 of the Tova settlement of Ra Province. Practically 100 per cent purity was achieved with farmers' padi, and dhal (mung) which was treated by the machine on these two occasions and it was particularly noted that seeds of the noxious weed muraina grass (*Ischaenum rugosum* Salisb.) were readily separated from the padi by this means. This is an important fact which should be noted by those farmers who suffer from the serious infestation of this weed in their padi fields.

Farmers, therefore, are strongly advised to contact the Agricultural Officer of their district so that they can arrange to have their padi thoroughly winnowed by this machine and thus stop the practice of sowing weed seeds with their seed padi, maize, etc. No charge will at present be made for this service to farmers.

2. RICE GROWING 1945/46 SEASON.

THE rice planting season has on the whole been a favourable one, and plantings have gone ahead satisfactorily. It is estimated that the area planted will equal that of the 1944-45 season.

A hurricane visited parts of Viti Levu in February 1946, but little damage appears to have been done to rice fields and provided weather conditions do not deteriorate it is expected that yields will be nearer to normal this season than they were last.

Outbreaks of "rice yellows" have been recorded in one or two places, but the advent of rain appears to have cleared up the condition.

The disease is under investigation and experiments have been laid out at the Central Agricultural Experiment Station, Naduruloulou, which it is hoped will throw light on this condition, so that suitable treatment may be evolved to combat it.

3. PRODUCE.

SUPPLIES of native foodstuffs have been plentiful during the last quarter, but European types of vegetables were in short supply and show the effects of the lack of suitable manures, supplies of which are still unobtainable from overseas.

For the export market, it is satisfactory to note that bananas came forward in quantities comparable with pre-war shipments, while pineapples (as fresh fruit) were again available in quantity for export. The following figures, covering exports to New Zealand for the three months December 1945 to February 1946, show the gross quantities shipped representing an approximate value of £19,000 (Fiji currency).

Bananas	30,105 cases
Pineapples	1,971 "
Mangoes	500 "
Avocado pears	21 "
Miscellaneous fruits	12 "
Peanuts	219 bags
Green ginger	23 "

4. ERADICATION OF NUT GRASS IN INDIA.

IN the journal *Indian Farming*, Vol. VI, No. 3 of March 1945, issued by the Imperial Council of Agricultural Research, India, a very interesting article dealing with experiments designed to eradicate nut grass (*Cyperus rotundus*) is published. The following is a brief summary which may be of interest to farmers in Fiji.

As stated the object of the experiment was the eradication of nut grass from arable land and it included five cultural treatments with four replications. Three of the treatments were not cropped, the plots being kept stirred at fortnightly intervals over a period of two years, using a "Victory" plough, a Cooper plough No. 11 and H.M. Guntake No. 2 (a small bladed harrow capable of working at a depth of three to five inches. All plots were heavily infested at the commencement of the experiment.

After two years treatment the following results were recorded:—

- (1) Plots kept fallow and cultivated at fortnightly intervals were practically free of nut grass.
- (2) Plots cropped normally and cultivated at fortnightly intervals during the noncropping period, together with,
- (3) Plots cropped normally and cultivated at normal intervals showed no effect on the nut grass infestation.

Counts of live nut grass bulbs taken in two feet square plots periodically in all plots showed that for—

- (1) above, infestation was reduced from 1,500 bulbs to 25 bulbs, (2) showed practically no reduction and (3) a slight increase 1,400 to 1,500.

The conclusion reached is that by keeping infested land fallow for two seasons but cultivating it at fortnightly intervals, nut grass is practically eradicated.

In view of the fact that heavily infested land produces year after year poor crops, all too often at a loss, it would appear worth while to try out the long fallow with fortnightly cultivations, since not only would the nut grass be destroyed but the long fallow would increase soil fertility and give heavier and more profitable cropping.

H.R.S.

REVIEW.

THE DISTRIBUTION, STATUS AND CONTROL OF
NOXIOUS WEEDS IN FIJI.

COUNCIL Paper Number 35 for 1945 deals with the above subject and, in view of its value to all interested in agriculture, the following is compiled largely by expansion of the recommendations of the Committee which met on six occasions through 1944 and 1945.

In the first place it is suggested that noxious weeds be grouped into two categories or schedules namely, primary and secondary, according to which the presence of any primary weed within an area proclaimed for such weed is itself an offence whereas for secondary weeds an offence is not committed unless they are present after a written order by an inspector to eradicate them. The full details are:—

SCHEDULE I—PRIMARY NOXIOUS WEEDS.

NOTE.—The presence of any weed in this Schedule on land within the area proclaimed for such weed will in itself constitute an offence.

1. *Acacia farnesiana* Willd. Ellington Curse.—Throughout the Colony except the tikina of Raviravi, Rakiraki, Naroko and Navolau in the Province of Ra.

2. *Sorghum halepense* (L.) Pers. Johnson grass.—In districts bordering present infested area—to be determined.

3. *Mimosa invisa* Mart. Giant sensitive plant.—Throughout the Colony.

4. *Opuntia* sp. Prickly pear.—Throughout the Colony (precautionary measure only).

5. *Elephantopus mollis* H.B.K. Tobacco weed.—Throughout the Colony.

6. *Ischæmum rugosum* Salisb. Muraina grass.—Throughout the Colony, ultimately. To be declared by districts as and when the Department of Agriculture can provide the facilities outlined in Recommendation (k).

7. *Xanthium italicum* Moretti. Noogoora burr.—Throughout the Colony, excluding the Provinces of Nadroga and Navosa, Ra and Ba.

8. *Solanum torvum* Sw.—Vanua Levu and Taveuni.

SCHEDULE II—SECONDARY NOXIOUS WEEDS.

NOTE.—An offence is constituted in respect of any of the weeds in this Schedule only by neglect to comply with the terms of a written order by an Inspector.

1. *Solanum torvum* Sw. Solanum weed.—In the existing declared areas (Tailevu and Serua) and to be extended to include Rewa, the whole of Tailevu, and Naitasiri, and to other districts later.

2. *Urena lobata* L. Hibiscus burr.—As for Solanum weed.

3. *Eichornia crassipes* Solms. Water hyacinth.—Proclaimed area to be determined.

4. *Clidemia hirta* Don. Köster's curse.—Proclaimed area to be determined.

5. *Hyptis pectinata* (L.) Poit. Mint weed.—As for Solanum weed.

6. *Sida acuta* Burm. f. Broom weed.—Proclaimed area to be determined.

7. *Acacia farnesiana* Willd. Ellington curse.—Tikina of Raviravi, Rakiraki, Naroko and Navolau in the province of Ra.

8. *Sorghum halepense* (L.) Pers. Johnson grass.—In districts where well established and not proclaimed in Schedule I—to be determined.

9. *Xanthium italicum* Moretti. Noogoora Burr.—Nadroga and Navosa, Ba and Ra.

Another important recommendation is that landlords, including the Crown and Native Lands Trust Board, should refuse the grant of short term leases (particularly of grazing licences and agreements); further, all leases should include conditions which limit the head of livestock depastured and land should have boundary fences and be subdivided. Control of livestock, including movement and roadside depasturing, should be investigated.

It is suggested also that the sharing of fencing costs between adjacent owners be considered as is done in Australia and New Zealand and that in appropriate cases weed clearing should be done in lieu of rent as with Maori land in New Zealand.

The Department of Agriculture should, it is recommended:—(1) appoint a full-time Weeds Inspector, (2) certify weed-free rice seed for planting, (3) provide such seed clearing machinery for hire or sale, (4) undertake investigations into direct control of weeds as well as pasture and grazing improvement.

Funds are recommended for the purchase of flame throwers and fuel for the experimental control and clearing of weeds in road reserves, also for propaganda, in the three languages of the Colony, by means of illustrated leaflets.

The report itself is very comprehensive, giving the distribution of weeds in the various Agricultural Divisions (with particular reference to the Provinces of Rewa, Serua, Tailevu, Nausori, Ra and Kadavu) and the factors affecting the spread of the weeds of which short term leases and grazing licences besides mismanagement of land and stock are the main causes. Control measures comprise legislation and propaganda, cultural measures (tillage, smothering, biological and chemical) and it is of interest to note that certain herbicides are already on the way to be tested against selected weeds. All plants referred to are listed in an appendix with their popular and botanical names.

Enough has, it is hoped, been given to indicate the scope of the Committee's report which has certainly rendered valuable service in summarising the present status of weeds in the Colony.

—R.J.A.W.L.

THE GIANT TOAD IN QUEENSLAND.

UNDER the above title in this journal for June 1940, was an extract on the insects eaten by the giant toad in Queensland. The following should therefore be of interest coming as it does nearly six years later and dealing with the cane borer weevil common to Fiji and Australia.

CANE BEETLE BORER.

“Populations of the sugar cane beetle borer (*Rhabdoscelus obscura* Boisd.)* remained at the comparatively low levels characteristic of the past few years. Under normal circumstances with the heavy rainfall of 1945, the position regarding this pest would be expected to have deteriorated considerably. Cane growers attribute this in no small measure to the giant toad, and there is no doubt that the pre-harvest burning of cane crops carried out during the war period has been an important factor in keeping the borer at its present low level.”

“The Australian Sugar Journal”

15 December, 1945.

* Formerly *Rhabdocnemis*. Editor, *Agricultural Journal*.

NOTES FROM CENTRAL AGRICULTURAL STATION, NADURULOULOU.

By B. E. PARHAM, Agricultural Officer, Southern.

1. FODDER AND PASTURE TRIALS.

REFERENCE has been made in previous numbers of the *Journal* to the establishment at Naduruloulou of a number of useful fodder and pasture plants⁽¹⁾. The present note records briefly the progress of this work which has been planned in two phases: (a) introduction and propagation; (b) establishment and trial under field conditions.

It may be stated that the following plants have been successfully grown in propagation plots:—

(i) Grasses—

- Pennisetum purpureum*, elephant grass; 2 strains.
- Pennisetum pedicellatum*, Kyasuwa grass; 2 strains.
- Melinis minutiflora*, molasses grass.
- Tripsacum laxum*, Guatemala grass.
- Dicanthium annulatum*, tufted blue grass.
- Dicanthium caricosum*, Nadi blue grass.
- Dicanthium nodosum*, tall blue grass.
- Ischaemum aristatum*.
- Chloris gayana*, Rhodes grass.
- Paspalum* sp.

(ii) Legumes—

- Pueraria phaseoloides*, tropical Kudzu or "Puerdo".
- Pueraria thunbergiana*, Kudzu vine.
- Stylosanthes guianensis*, pencil flower or "Stylo".
- Centrosema pubescens*, butterfly pea or "Centro".
- Calopogonium mucunoides*, "Calopo".
- Desmanthus virgatus*, Acuan.
- Desmodium discolor*.

Several of these have been used in preliminary feeding trials and have proved palatable to cattle, pigs and horses at the station, whether hand-fed or grazed.

Desmanthus has been used freely for pigs; and a mixed feed of chopped Para or elephant grass with either *Stylosanthes*, *Pueraria* or *Calopogonium*, has proved attractive to working animals and milking cows. In the field, cattle tend to remain in that part of the area where these legumes are present in preference to the rest of the pasture.

In order to study the behaviour as regards yield and duration of these plants under normal farm conditions, the second phase of the work is being proceeded with. Twelve test plots, each one-tenth of an acre in area, have been prepared and planted with the above listed species. These plots will be used in controlled grazing trials which will, it is hoped, confirm the preliminary observations made to date.

In order to facilitate the hand feeding of stock with selected fodder grasses and legumes, stock shelters have been constructed where the animals are fed and bedded down at night. Although a shelter with thatched roof and bamboo walls have proved quite satisfactory, a trial is being made with a roof constructed of bamboo tiles. The stall feeding of stock is associated with the preparation of farmyard manure and compost which is used for top-dressing adjacent pastures. The possibility of maintaining the maximum number of animals on a limited area without pasture deterioration by providing supplementary fodder grown on marginal or more hilly land is being investigated. For this purpose elephant grass, Guatemala grass, *Pueraria*, *Desmanthus* and *Stylosanthes* show great promise.

The establishment and maintenance of pastures on flat and hill land has been limited by the inadequate areas available at the station for full-scale trials. The two principal areas used for general pasture work each occupy approximately six acres, subdivided into three paddocks. The flat land carries a uniform stand of para grass with some *Mimosa* and *Desmodium*, typical for the region. The hill area, which formerly carried only a shrubby waste of *Lantana*, guava and associated weeds has been brought under pasture comprising mainly a mixture of *Ischaemum* grass, Para grass and *Desmodium* with some *Mimosa*. In both areas the improvement resulting from rotational grazing has been well demonstrated in the steadily increasing yield of palatable fodder and in the control of weeds with a minimum of work over a period of some six years.

The production of seed and plant material for distribution to farmers is being attended to but the demand in recent months has been heavy and cannot be met until the propagation plots are extended. For this reason subsidiary plots have been established at Dobuilevu and Waimaro stations; and it has been necessary to advise farmers to prepare propagation plots on their own land with what seed has been made available. At present the plants in greatest demand are the blue grasses, *Stylosanthes*, *Pueraria* and elephant grass.

In the course of this work much attention has been necessary to suitable and rapid methods of propagating some of the plants; and provision has been made in collaboration with the Senior Chemist for analyses to determine the seasonal variation in nutritive value of the various species.

2. KUDZU VINE (*Pueraria thunbergiana*).

In view of the current interest in this plant which has come into prominence recently in U.S.A. in connexion with the control of soil deterioration, it may be of interest to record that a small plot has been under observation since 1943 when a small quantity of seed was obtained from Australia.

The results to date have not been very promising, the growth of the plants has been very slow and they are subject to attack by leaf-eating caterpillars. This species does not compare in vigour of growth with the related so-called tropical kudzu (*P. phaseoloides*) which is thoroughly established and growing freely.

It may be noted that the indigenous creeper known to the Fijians as "wakaya" which grows commonly in open situations in all parts of the Group has recently been determined as being identical with kudzu. It was formerly known as *Pachyrrhizus trilobus* which is the yam bean, and does not anywhere form the heavy growth characteristic of the tropical species which appears much more suitable for local conditions.

3. SWEET CORN; U.S.D.A. 34.

During the past ten or twelve years many introductions and trials of sweet corn varieties have been made by the Department. The most satisfactory of these, so far as conditions in the wet zone go, has been the tropical hybrid corn known as U.S.D.A. 34, received from Puerto Rico in 1936.

This variety is hardy and of robust growth producing a heavy crop of excellent quality corn for table use with a minimum of effort. It is suitable either for the small garden or for field cultivation and, in view of the present shortage of rice, attention is again drawn to this crop and to the fact that seed is available for distribution.

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BOTANICAL NOTES.

By B. E. PARHAM.

THE following notes on local plants of interest to farmers and others are compiled from laboratory records of plant material collected by the staff or sent in for determination.

1. *Nopalea cochinellifera* Salm-Dyck. (Family Cactaceæ)—

Common name: Cochineal Cactus.

Description: A fleshy shrub with a cylindrical trunk and jointed branches of ascending or spreading obovate-oblong joints up to one foot or more long. Areoles scattered, bearing white wool with small barbed spines and sometimes long spines in young plants or growth. Spines usually absent or falling early.

Flowers solitary arising from the areoles or near the edges of the joints, crimson 5 to 7 cm. long; sepals and petals erect, stamens much longer than the petals. Fruit red, 5 cm. long; ovary 3 cm. long with a deep depression at apex, not sunk in the joint.

Locality: Levuka—No. 3002—collected by L. H. Dietrich.

Distribution: Grown in various parts of the Colony as an ornamental or for medicinal purposes, being used by Indians as a poultice. Locally the growth of this plant is very slow and nowhere can it be said to be truly naturalized.

Original habitat is unknown; has been introduced into many parts of the world because, as the specific name indicates, this is the principal species of Cactus on which the cochineal insect was grown.

This plant is not likely to become a weed in the Colony and is to be distinguished in this respect from species of *Opuntia* or prickly pear.

2. *Sida acuta* Burm. f. (Family Malvaceæ).

Common name: Broom weed.

Description: Perennial or annual herb or undershrub, 1-5 feet high, erect or semi-prostrate, branching. Leaves 1-8 cm. long, irregularly serrate; petioles 5 mm. long; stipules 1 to 1.5 cm. long, sublanceolate to linear. Calyx 6-8 mm. long often with minute stellate hairs and long simple hairs on margins and nerves, 10-nerved, lobes acuminate.

Flowers at first solitary, later with a flowering branch developing; petals orange-yellow or white. Carpels 5 or 6 when ripe, 3-4 mm. long, with margins of back sub-created, sides net-veined, apex with 2 very short beaks puberulous with very minute stellate hairs. Seeds glabrous but puberulous near hilum.

Locality: Viti Levu—dry zone from Ellington in Ra to Cuvu in Nadroga—Parham, Nos. 2809, 2907, 2914. Vanua Levu—Macuata Province, Vuo, Wailevu and Tabia. No. 5583. Taveuni—Wairiki, Mua, Vuna.

Recent infestations of grazing land on Vatia Peninsula and at Yaqara were reported in May 1945 by Mr. N. Chalmers⁽³⁾, who stated that the plant had in a short period of time become an aggressive weed and a menace to stock raising in the area. He considered it to be a recent introduction probably from America.

Major infestations have been seen at Ba, Vatia and Yaqara; and collections sent in by Mr. D. A. Donald (Agricultural Officer Western) and by Mr. N. Sanders (Veterinary Officer Western) have established the presence of this plant throughout the dry zone regions of Viti Levu.

Specimens sent in by Mr. L. W. Harwood (Agricultural Officer Northern) have confirmed its presence in Macuata Province (at Tabia) and the writer has collected it at Vuo and Wailevu in the Labasa district as well as in Taveuni where it is common.

Mr. Greenwood⁽⁶⁾ has recorded this plant under the name *Sida carpinifolia* L. and states that it has been in Fiji for 25 years and that it does "not grow gregariously like *S. rhombifolia*". The extensive stands of this plant to be seen in many localities do not support this observation.

A specimen (No. 1505) was collected at Vatia Point in May 1939 by the late W. L. Parham and this tends to confirm the view that the species is not a new introduction. It is possible that the recent rapid spread over many miles of territory in the short space of two years has originated from recently accidentally introduced seed, or is due to changed conditions in the area following a long dry period in 1944 and unavoidable overstocking of pastures.

Distribution: The plant is a native of the West Indies and Central America but has spread to most tropical and subtropical countries.

In the Pacific region it has been recorded as of early introduction in the Marquesas and the Austral Islands⁽²⁾, has been credited to Tahiti by Setchell⁽⁸⁾ and to Rarotonga by Cheeseman⁽⁴⁾ and by Wilder⁽¹¹⁾. In Nigeria, Ainslie⁽¹⁾ lists it as commonly used in native medicine. In Brazil, Silbersmidt⁽⁹⁾ has recently studied the transmission of an infective chlorosis virus disease of this and other species of *Sida*.

The following specimens may be cited, the numbers being those of the collection at the Department of Agriculture, Naduruloulou:—

Locality: Viti Levu—Vatia Point, sea level, Parham 1505; Ellington, roadside 2820; Yaqara, pasture land 2829; Vatia Peninsula grazing land and roadsides, sea level to 500 feet—Parham 2809, 2810; Nadi 2915; Nadroga near Cuvu 2907.

Status as a weed.—The plant may be distinguished from the widespread *Sida rhombifolia* L., known locally as Paddys' lucerne or pig weed (native name "cavutacidra") by the much shorter peduncles and by the pale green colour of the foliage.

It has not been recorded in the available literature as a major weed anywhere; but the recent infestations in the dry zone of Viti Levu are so extensive and heavy in grazing land that it is felt that it should be dealt with as a noxious weed. Observations locally indicate that it is spread principally by stock and that the infestation of land is mainly due to over-grazing of pastures and lack of control of stock movement.

Control measures are difficult to set down in view of the nature of the plant and the type of the country in which it occurs; but the following means of dealing with the weed are suggested—

1. Quarantine aimed at minimizing spread to adjacent areas. This would necessitate declaration of the plant as a noxious weed, the control of stock movement and the immediate clearing up of road margins and land adjacent to all roads and stock routes within the infested areas. This could only be achieved by the collaboration of all stock owners in the affected districts and the provision of holding yards or fences for travelling stock. Such concerted action would greatly reduce the further spread of the weed.

2. Control within infested areas should aim at the margins of infestation in the first instance by attention to fencing, both boundary and subdivision so as to keep stock out of infested areas, to local control of stock or farm holdings by the use of holding paddocks in between transfers from one part of farm to another. Direct attack by hand weeding of lightly infested pastures has proved effective and is a method greatly reducing the spread of the weed.

Mechanical destruction of the weed by rooting up, discing, ploughing or crushing is possible only in certain areas. The use of weedicides, flame

throwers at the proper growth period would be effective in reducing established stands but must be followed up by the sowing of seed of grasses or other fodder plants. For this purpose the blue grasses show great promise—and the use of smother plants as the legumes *Pueraria*, *Centrosema* or *Desmanthus* are to be recommended as *Sida* spp. cannot tolerate shade.

The use of weedicides is limited to those chemicals which can be used without fear of stock poisoning—unless of course it is possible to exclude stock from treated areas for the requisite period.

Sodium chlorate is best used on young growth, the application recommended being at the rate of 150 gallons per acre of solution, ($\frac{1}{2}$ lb to 1 gallon).

Indirectly the problem of controlling this weed may best be met by improvement of pastures by encouraging the growth of turf, rotational grazing, liming and by the planting of fodder crops to overshadow the weed. Measures aiming at the prevention of the spread of the weed to clean pastures are most important.

3. *Chenopodium ambrosioides* L. (Family Chenopodiaceæ).

Common name: Mexican tea, hedge mustard, bitter weed.

Fijian name: Wai-ni-ukuwomu.

Description: A tall aromatic herb up to 4 feet high; leaves simple, alternate, exstipulate with short stalks, lanceolate-oblong, sinuate toothed, glandular beneath, 5 to 8 cm. long, 1 to 2 cm. broad.

Flowers in clusters with hermaphrodite, female and occasional male flowers. Perianth 1 mm. long, segments 5. Ovary with glandular bodies. Hermaphrodite flowers with 5 exerted stamens; ovary with 2 to 3 short stigmas. Female flower with 3 long exerted stigmas. Utricle globular.

Seed somewhat compressed, smooth, round; embryo not completely annular, imperfectly enclosing the endosperm.

Locality: Viti Levu—Nadi, collected by Agricultural Instructor Apimeleki and reported as a troublesome weed in the locality. Parham Nos. 2917, 2918, 2919. This is the first record of this species for Fiji.

Distribution: Temperate and tropical regions of the whole world.

The whole plant has a reputation as a vermifuge. Ainslie⁽¹⁾ says that in Nigeria an infusion of the plant is used in native medicine as a febrifuge and for indigestion and as a laxative, also for coughs and tuberculosis. The seeds and buds are used as an anthelmintic and vermifuge.

Oil of chenopodium is used particularly in anchylostomiasis. The Fijian name means hookworm medicine.

4. *Malvastrum coromandelianum* Garcke. (Family Malvaceæ).

Common name: Clock plant.

Description: Perennial branching herb, 1 to 4 feet high, young stems and branches, the leaves on both sides, petioles, peduncles and calyx covered with stiff white adpressed hairs, simple or 2 to 4 branched. Leaves 3 to 5 cm. long, ovate, ovate-oblong, petioles 1 to 2 cm. long; stipules 7 to 9 mm. long, lanceolate, acuminate. Flowers yellow, on short peduncles, at first solitary in the axils, a subsidiary flowering branch appearing later; bracteoles about as long as the calyx and adherent to the base; calyx about 5 mm. long, lengthening in fruit, many angled; petals 1 cm. long; carpels 9 to 12 with a long spine near the apex and two short spines near the middle of the back; seeds kidney-shaped.

Locality: widely distributed throughout the dry areas of Fiji where the species is a common weed of roadsides and waste places. It often grows along with *Sida rhombifolia*, and with that plant is known in some countries as "clock plant" on account of the marked and regular periodicity of flowering.

Among specimens recorded are those from the following places: Vanua Levu—Labasa, Parham 2896; Ovalau—Levuka, Parham 1135; Viti Levu—Suva, Parham 1891; Rakiraki, Ra Province Nos. 1682, 2824.

Distribution: A native of Central America, this species has spread to most tropical countries.

The plant contains a mucilaginous sap which in the West Indies is used as a substitute for soap in washing coarse clothes.⁽⁵⁾

5. *Cuphea carthagenensis* (Jacq.) Macbr. (Family Lythraceæ).

Common name: Tarweed or Navua grass.

The present note corrects that published in the *Agricultural Journal* Volume 10, Number 1, page 21, 1939, under the name *Lythrum hyssopifolium* L. which is one of many names that have been applied to this plant; but that have been amended recently by a determination by R. C. Foster as recorded by A. C. Smith.⁽¹⁰⁾

This American weed is extremely common in damp pastures and rice-fields in many parts of the Colony and is no doubt a weed of many years standing.

Localities specifically represented in the collection are: Viti Levu, Wainibokasi, sea level No. 2590; Lomalaga No. 2448.

6. *Securinega samoana* Croizat (Family Euphorbiaceæ).

Fijian Name: Baumuri.

Description: Tree up to 40 feet high with rough grey bark; leaves alternate, entire, petioles short, usually red in colour.

Flowers clustered in the axils, without petals: males small, numerous subsessile, females fewer or solitary. Male flowers: sepals 5, imbricate, glands 5, alternate with the stamens; stamens 5, opposite the petals: ovary rudimentary. Female flowers; calyx as in male flower, ovary 3-celled, styles distinct, recurved 2-branched, ovules 2 in each cell. Capsule splitting up into 2-valved cocci.

Locality: Fiji, Viti Levu, Tailevu Province, Cautata: Parham 1200, 1201. Tonga, Togatabu: Parham 3073.

Distribution: Native of Samoa but introduced to Fiji, Rotuma and Tonga and established by natives who value the timber for house building.

Remarks: The rapid growth of this tree, its fine straight stems suitable for fencing, house posts, etc., and the great durability of the timber make it a valuable addition to the list of trees available for farm planting in the Colony. It has been established on Departmental stations at Doboilevu, Waimaro and Naduruloulou where seedlings are available for distribution.

The determination of this plant has been made by L. Croizat and communicated by courtesy of Dr. A. C. Smith of Arnold Arboretum. It is known in Samoa and Tonga as "poumuli".

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EXTRACTS.

THE EARTH'S GREEN CARPET.

A Neglected Imperial Asset.*

By SIR ALBERT HOWARD, C.I.E. (Fellow of the Imperial College of Science).

THE efficiency of our greatest Empire possession—our people—depends on the Big Five—air, water, food, warmth, and shelter. Without a supply of air life lasts but a few minutes: without water, only a few days: without food, it is only possible for the human body to exist on compensation for a few weeks. The control of the warmth factor depends on the climate of the particular corner of the Empire in which we live: even in a cold country like Great Britain we can do much to keep warm by making the fullest use of central heating in the shape of our own animal heat. The question of shelter, often dignified by the term—the housing problem—is the least important of the Big Five, in spite of the fact that so much attention is paid to it by present-day planners.

There is only one source of food—the earth's green carpet. In spite of all our science nobody has yet been able even to copy Nature's food factory—the green cells of the leaves of plants which, by means of the energy of sunlight and simple things like air and the soil water absorbed by the roots, manufacture for the plant and incidentally for livestock and ourselves all the carbohydrates, proteins, fats, vitamins, and so forth, on which we live. Both this food factory—the green cells of the leaf—and the power which drives it—the energy of sunlight—are the gift of Providence. It owes nothing to mankind, who is quite unable to devise anything so fundamental or so efficient. All we can do to make the most of this machinery are two simple things: (1) we can restore and maintain the fertility of the soil underneath the green carpet, and (2) we can select crops which make the very most of a fertile soil and of the energy of sunlight. The restoration and maintenance of the fertility of the soil depends on a constant supply of freshly-prepared humus made from vegetable and animal wastes: the selection of the most suitable crop depends on the flair possessed by the plant breeder in finding a plant to fit the soil and climatic conditions. To obtain the maximum output of this natural food factory we must always arrange that these two factors co-operate: the best yields can only be obtained by a happy combination of a fertile soil and of an improved variety. If we improve the variety by itself without at the same time making the soil more fertile, as is now the rule in most agricultural departments, we produce a plant which helps to wear out the soil. The improved variety by itself is always a boomerang.

Besides the provision of food for livestock and mankind the earth's green carpet manufactures directly or indirectly a vast amount of the raw materials needed by our factories. All the vegetable fibres like cotton, jute, sisal, and hemp; all the vegetable oils; all the timber used in construction; all the cellulose from which artificial silk is made, as well as the tanning materials and some dyestuffs, are directly the produce of crops. The plant is also the source of all the various animal products which find their way as raw materials into manufacture. Our Empire would, therefore, soon come to an end but for Nature's great plant factory.

How has the white man preserved and made the most of the earth's green carpet? What has he done to maintain its efficiency? We can answer these questions best by describing what has happened to two regions, selected at random, which within the last hundred years or so have been colonized by emigrants from Europe.

* An address delivered before the Cambridge Branch on October 9th, 1944.

Let us first consider the United States of America, where vast areas of virgin land have been made into farms and where a careful appraisal has recently been conducted on the present condition of the agricultural land. The results speak for themselves. No less than 253,000,000 acres, or 61 per cent of the total area under crops, has suffered from soil erosion to such an extent that it had either been completely destroyed or had lost most of its value. Only 161,000,000 acres or 39 per cent of the cultivated area could be safely farmed by present methods. In less than a century the United States has, therefore, lost nearly three-fifths of its agricultural capital. The root of this soil erosion trouble in the United States is misuse of the land. The causes of this misuse include lack of individual knowledge of soil fertility on the part of the pioneers and their descendants; defects in farming systems, in tenancy, and finance—most mortgages contain no provisions for the maintenance of fertility; instability of agricultural production (as carried out by millions of individuals), prices and income, in contrast to industrial production, carried on by a few corporations. All these troubles can be traced to the transfer of the soil's capital—soil fertility—to the pockets of the farmers.

In New Zealand the results of land settlement by our own people are perhaps even more disquieting than those just described. In this Dominion agriculture took the form of the creation of pastures for sheep and cattle by first removing the forest and then by stimulating the grass carpet by the excessive use of chemical fertilizers, superphosphate in particular, which soon led to the speedy exhaustion of the land. Soil erosion is rapidly increasing; vegetables have lost their taste; the health of the livestock is deteriorating. But something even more alarming is taking place. The more far-seeing of the population have for some time been disturbed by the growing signs of malnutrition and the increase in the number of patients in hospitals and asylums. Admissions into public hospitals have shown a gradual increase up to 126 per cent. Mental cases have gone up by 100 per cent. The incidence of illness among young children is alarming: every year before the school age is reached some 80 per cent are found to be physically defective in some way: of every 100 children who enter New Zealand schools, 15 show signs of needing medical attention, 15 need observation, many show signs of nose and throat trouble, and at least two-thirds have dental caries.

These results, which could be repeated from many other parts of the British Empire—Australia, Africa, Ceylon, and the West Indies in particular—are not impressive. They prove beyond doubt that something must be very wrong somewhere in the way the earth's green carpet is being looked after.

What is this soil erosion and what is it due to? This question is soon answered. We have only to examine the way Nature—the supreme farmer and gardener—manages her vegetable kingdom to arrive at the truth. Here soil erosion is unknown and there are no asylums or hospitals for the casualties among her animal population.

If we consider, for example, what is going on in any wood or forest, we shall find a complete set of arrangements for converting all the vegetable and animal wastes into leaf mould (humus) and then for incorporating this humus into the surface soil. Here it feeds an enormous soil population—such as earthworms, insects, moulds and microbes—whose waste products then feed the roots of the trees and undergrowth. The forest manures itself. The soil is kept permeable (to water and air) by the device of the compound soil particle which is made up of minute fragments of mineral

matter glued together with bits of organic cement supplied by the dead bodies of the soil bacteria. It is because of these compound soil particles that the forest soils are able to drink in the whole of the rainfall, to pass the surplus water into the subsoil for feeding the springs and streams. When this is arranged for no soil erosion occurs. In the soils of the forest these compound soil particles are never jammed up together, but leave spaces between—we call these collectively the pore space. They are the living rooms both of the soil population and of the absorbing portions of the roots of trees and indeed of all green plants. Soil erosion is only possible when the compound soil particles break down wholesale, when the small fragments left can be easily removed by wind or water.

Now in the United States and New Zealand our farming operations have, in less than a century, resulted in soil erosion, in other words in the permanent destruction of the pore spaces of the soil. The roots of crops and the soil population have been deprived of their Big Five—air, water, food, warmth, as well as their living rooms. Much more than an acute housing problem has arisen. Nature registers her disapproval of our soil management by sweeping away the ruins of the murdered soil by means of water or wind, so that in due course new soil can be made under the sea a few centuries later and agriculture can have a fresh start. In the meantime the green carpet of the eroded lands cannot function properly. The manufacture of food is first reduced and eventually something like a desert results.

All over the British Empire, and indeed in many other parts of the world, the earth's green carpet is being treated very much as it has been in the United States and New Zealand. Soil erosion is spreading, followed by malnutrition and disease in livestock and mankind, very much as in New Zealand. All this trouble is due to a want of understanding of Nature's laws on our part, aggravated by the fear of want. These two factors working together create the profit motive—the desire to accumulate riches so that we can feel secure. We have just seen the failure of this desire for security in recent happenings in France where a Maginot Line was constructed at great cost to keep out the Nazis. We ourselves all cherish our private Maginot Lines in the shape of our possessions for keeping us free from a possible want. Hence the urge of the profit motive. This is the root cause of what has been happening among farmers all over the world. They are paying too much attention to profit and are not looking at crop production as a whole.

Crop production involves two processes—growth and decay—both of which are equally important and which must be balanced. If we speed up growth, we must accelerate decay. It is just here that such a tragic mistake has been made in utilizing the earth's green carpet. We have exhausted the fertility of the soil which underlies this carpet, and have not realized the imperative character of Nature's great law of return. If we disobey this or any other of Nature's laws, she hits back. When the law of return is flouted, her answer is first soil erosion and then a desert with such things as malnutrition and disease thrown in, as it were, to make full measure.

How can we put matters right? In a very simple way: by converting all available vegetable, animal, and human wastes into humus and so restoring the fertility of our soils. At the same time we must give up as quickly as possible the use of artificial manures, which only put off the evil day of reckoning for a brief period and ultimately make matters worse. Just as we cannot hope to find a substitute for the mechanization of the green cell, neither can we improve on the way Nature maintains the soil under her green carpet.

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PREVENTION OF WASTE IN THE USE OF GRAIN BAGS.

By

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THE scarcity of bags and the difficulties of importation make it imperative that the greatest care should be exercised by all users of grain and other bags to prevent unnecessary wastage and in so doing to obtain the fullest and most economical use of the supplies available.

In the past the wastage of bags has been exceptionally high and even to-day many thousands of bags are handled so carelessly that they do not last as long as they should.

CAUSES OF WASTAGE.

The following are some of the most important causes of wastage; and users of bags are advised to bring them to the notice of their employees:—

(1) *Slashing open of tops instead of carefully cutting the twine with which the bag is sewn.*—Even new bags are often treated in this manner.

(2) *Dragging bags over rough floors or over the ground.*—Nails projecting above flooring boards, sharp edges of cobble stones, rough cement surfaces and stones or other objects on the surface can be as destructive as wilful slashing. A suitable porter's barrow or some other means of moving the bags without dragging them will soon pay for itself through the saving on bags.

(3) *Insufficient protection against rodents.*—In this case there is usually a loss of contents as well as bags, and suitable methods of protection are always worth while.

(4) *Exposure to moisture through lack of proper covering or through storage under leaky roofs.*—The fibre of which bags are commonly made readily absorbs moisture and soon rots when wet or damp. Contact with other substances such as oil, grease, tar, or creosote should also be prevented.

(5) *Stacking bags direct on cement or other moist surfaces.*—This is a very common cause of damage and one which can be easily prevented by first laying a base of poles, old planks, smooth stones or other suitable objects.

(6) *Carelessness in taking samples.*—All too frequently the grain probe or sampling tube is jabbed into the bag with the maximum force, so that the sharp edges of the probe act like a knife in cutting the fibre. No matter how small the hole which is made, the cut edges soon fray and the fibre unravels. Often a knife is used to make a slit, and cases have been brought to light where holes are even kicked into the bag to get at the contents for sampling.

(7) *Tumbling bags from stacks, wagons or lofts.*—This invariably results in a certain percentage of the bags bursting or tearing along the seams. Such bags are usually a complete loss for repair is difficult and costly.

(8) *Over-filling of bags.*—When bags are too full, they are subjected to severe strain in handling or stacking. As much free space as possible should be allowed, especially when the contents are heavy, so that the bag will have a certain amount of pliancy and the forces of stress become more evenly distributed.

(9) *Not emptying the bags completely.*—Meal, flour or grain left in bags attracts rodents and is an excellent medium for the development of rot-producing moulds if the bags are damp. All bags should be thoroughly emptied by turning them inside out and shaking off remains of contents before they are put into storage.

(10) *Lack of adequate protection in storing empty bags.*—Bags will attract rodents even when there is no grain or other food substances in them, for all common rodents, and rats in particular, are very partial to the fibre for nesting purposes. As another important cause of loss is rotting through dampness, complete protection of empty bags against rodents and thorough drying before storing them are absolute essentials in the preservation of such bags.

PROTECTION OF BAGS.

Bags containing chemical substances such as fertilizers or lime soon perish unless the injurious agents are removed. A good practice is to empty all fertilizers, etc., on to cement floors or into brick bins and to wash out the bags thoroughly without delay. Although such bags are generally unsafe for the transportation of grain they can be put to good use in harvesting operations in the field, thereby effecting a considerable saving in grain bags.

To save costs and labour in repairing damaged bags, timeliness should be regarded as a first principle. The longer the delay the more difficult it is to repair bags and the less satisfactory is the result.

—From *Farming in South Africa*, Vol. 17, pp. 511-512, Aug. 1942.

KUDZU AND SOIL EROSION—A WARNING NOTE.

EROSION of the soil is a problem of world wide anxiety. Nowhere is it the occasion of graver concern than in the British Empire and Commonwealth. Any discovery research might make that promised to be a preventive or a cure is bound to be seized upon with eager hope. It is therefore not surprising that an article in an American magazine on Kudzu "another agricultural miracle," extracts from which have been sent to us by a correspondent, should be hailed as exciting news. The "miracle" worker is a Japanese vine, and the story of the transformation resulting from its planting on a farm in Alabama which was definitely becoming derelict, is undoubtedly thrilling. To-day, we are told, the farm stands out as a green oasis, due to the growth of a vine which might have been regarded as a menace rather than relief. Kudzu has not only stopped erosion, it has improved the soil into which it is ploughed; crop yields are increased many-fold; improved stocks of cattle are raised, and even chickens yield more eggs.

All this is so remarkable that the record of what has been and is being done in America, may easily induce victims of erosion elsewhere to turn to Kudzu for salvation. We have therefore made inquiries in quarters where Kudzu is well known, to ascertain whether the plant is likely to be of service elsewhere that it has been in Alabama and Georgia. The response is a warning. Kudzu, we learn, has been for years under trial in the British Colonies for erosion control and general soil rehabilitation. It has been a success in only a limited number of cases. It would appear that it prefers the conditions in more or less temperate climates rather than purely tropical zones. In the Highlands of Kenya and other parts of East Africa some fair growths have occurred, and we are informed that the American Department of Agriculture has a number of other plants which it is using as well as the Kudzu vine, and some of these seem to have better possibilities for British Colonial needs. The optimism of the writer of the American article must therefore be sharply discounted; Kudzu's success in certain areas of America does not justify the idea that it could be repeated over a wide range of soil and other conditions.

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